PURDUE
UNIVERSITY

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#09-615(WPCB) [CFO Rulemaking]
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Office of Legal Counsel
Indiana Department of Environmental Management
100 North Senate Avenue MC 65-46
Indianapolis, Indiana 46204-2251

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ENVIRONMENTAL MANAGEMENT
OFFICE OF LAND QUALITY

Ms. Pittman:

These comments on the CFO Rule Notice for LSA Document #09-615 are duly submitted by the undersigned faculty in the College of Agriculture at Purdue University. This group of scientists collectively has a vast expertise within Agricultural Economics, Agronomy, Animal Sciences, Environmental Sciences, and Soil Sciences; has a long-history of being nationally and internationally recognized in manure and nutrient management issues; and has been and are currently being consulted to craft policy, determine policy implications, and assist in implementation of policy pertaining to livestock and the environment domestically and globally. It is within this framework that we applaud IDEM for its efforts to improve environmental policy to reduce the impact of animal agriculture on water quality in Indiana. However, there are several technical issues that we believe must be addressed. Therefore, we intend this letter to convey technical comments related to environmental impacts and benefits, implementation, and plausible economical feasibility of the proposed rule for the agricultural community as well as for the citizens of Indiana. Because this rule will plausibly require substantial changes to management practices in the agricultural community, we feel it is imperative that substantial guidance and education must be provided for timely and effective implementation (preferably a minimum of 6 months prior to implementation). For this reason, we are prepared to offer assistance and insight as this process unfolds with our technical experts and networks of Purdue Cooperative Extension Specialists and Educators to effectively communicate rule revisions to livestock and poultry producers for successful implementation and compliance.

Regarding preparation of a guidance document and educational outreach program for this rule as well as for the NPDES program, we would suggest including materials relating to (but not limited to) manure sampling, analysis and interpretation; estimating manure nitrogen availability; soil sampling, testing and analysis; preparation of the farmstead plan; timeline and checklists for all affidavits; and inspections and recordkeeping. Purdue University staff would be willing to assist in the preparation of these documents. Additionally, Dr. Joern and his staff are willing to work with IDEM to ensure that all calculations in Purdue University's Manure Management Planner software (MMP) comply with IDEM rules and, if

possible, to develop reports that aide in review by inspectors. Further, they are willing to develop GIS-based mapping and analytical software to address items proposed for the final rule.

Fiscal Impact - Currently, land application of manure for the majority of livestock operations has been based on *manure* nitrogen (N) content rather than *soil* N content (as written in the IDEM response to comments received from the 1st notice). While the IDEM comments contend that the majority of CAFOs are currently applying manure based on the phosphorus (P) needs of the expected crops, to date only approximately 200 CAFO operations have made this transition, whereas nearly 425 CAFO and all CFO operations have remained on the N-based system (estimates per IDEM staff in August-2010). Because existing operations were designed for a N-based manure application system with available acreage suitable for that system, soil-tests for P are likely to be over 50 ppm in many cases. Accordingly, changes in manure application from a N to P basis will increase the acreage needed by 2 to 3 times, and thereby create a tremendous financial burden on producers who will either need to acquire additional land, bear the cost of manure transport and application to land not under control of the operation, or reduce the animal units on their operations to less than the permitted numbers (which may render them economically unviable). While substantial and potentially detrimental financial impact is anticipated, an accurate estimate of the true fiscal impact may be difficult or impossible to obtain, because current soil tests for P are not available across the broad range of livestock operations and management systems within the state. Additional financial costs associated with the manure application basis likely will arise from the increased acreage required (whether owned or managed/controlled), fuel costs for transport and field application, equipment wear, labor for additional application time, likelihood for timely application due to weather, etc. The land requirements, and necessity to acquire additional land, for individual operations is likely highly variable across operations and difficult to estimate without current soil tests for P. We are not aware of any study conducted within Indiana, or any other state, that has evaluated the implied impacts of shifting from a N to a P-based land application on the increased land requirement, and therefore, associated cost increase, for manure application needed by CAFO/CFOs.

The new provisions also have potential to limit the ability of producers to adopt future technologies that might mitigate the fiscal impact of regulation. Managerial adaptation is the primary means by which regulated firms can remain economically viable while continuing to provide value to consumers. These unintended consequences of broad-based command and control regulation may also lead to social inefficiency by shifting the optimal scale of operations to something either smaller or larger than that which is socially desirable. For example, limiting manure applications to annual P needs may unintentionally limit the potential for producers to adopt new technologies that tailor diets, manure handling, and manure application to the nutrient needs of a multi-year crop rotation. To accurately assess the potential for adverse outcomes would likely require case study analyses that capture the diversity of farm scenarios encompassed throughout the state.

Additionally, other costs associated with this proposed rule include the development of storm water retention/pollution prevention, treatment, and disposal. Comments made during the second notice only referred to the incurred cost for the development of the plan, rather than costs directly or indirectly associated with the implementation of the plan, construction, surface grading, runoff collection,

storage, treatment, application and management. In many cases, creation of storm-water retention ponds, pumps for lagoons or other storage, irrigation systems, etc. will cause substantial economic impact to the operation. We contend that in many cases storm-water should have sufficiently acceptable water quality to be directly discharged into a properly designed, designated filtration area(s). Additionally, we submit that if the storm-water prevention plans are developed and approved, monitoring should not be required because the proposed monitoring for sediment and nutrient loading is not practical and does not provide any useful information related to environmental impact. Further, questions arise as to when and how runoff samples are to be collected for monitoring and if they indeed will be representative of environmental impact as intended.

Nutrient Excretion and Manure Nutrient use in Cropping Systems –

A) Manure excretion - IDEM should adopt the ASABE/NRCS excretion values (which several of the faculty writing this letter were instrumental in assembling) for the Guidance Document for this rule. These values are located at: http://policy.nrcs.usda.gov/OpenNonWebContent.aspx?content=17768.wba

B) Nitrogen availability from manure for crops -

327 IAC 19-2-28 "Potentially available nitrogen" defined:

Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4

Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30

Sec. 28. "Potentially available nitrogen" means the nitrogen that could be realistically taken up by a crop during one (1) growing season. Potentially available nitrogen is usually calculated as the sum total of: (1) ammonium nitrogen; (2) nitrate nitrogen; and (3) the percent organic nitrogen that will mineralize in one (1) growing season. (Water Pollution Control Board; 327 IAC 19-2-28)

Despite the definition of "Potentially available nitrogen", the term is not used in subsequent text. Use of the phrase "realistically taken up by a crop" could be taken as "all" or "loss due to timing of manure application". If needed, this definition should be revised to include losses due to application method and timing. IDEM's position of not allowing inclusion of N losses for manure based on time and application method is not based on science in any conceivable way; and Indiana is the only one of the 36 US states we have worked with that has such a policy. IDEM's position that many corn growers now monitor soil or plant tissue N levels is not supported by facts. The largest soil testing laboratory in the state has processed, on average, fewer than 2300 soil N tests per year since 2006. Even if other soil testing laboratories in the state collectively tested an additional 2700 soil samples, this still would represent fewer than 200,000 acres of corn each year (roughly 3 percent of Indiana's corn crop) assuming that each sample represents approximately 40 acres (soil tests should not represent more than 20-30 acres for best management and should probably not represent more 40 acres in this rule). Far fewer acres are represented by use of plant tissue tests.

For planning purposes, reasonable estimates of N losses based on manure source, time and method of application are available. In addition, in 2008 IDEM staff informed us that any commercial fertilizer applied to cropped fields receiving manure at an N-based rate would be cited for an over-application of N. This leaves producers with two options; relying on pre-side dress nitrate test (PSNT) to determine supplemental N needs that are based on very little research data (nearly all PSNT work was done without the application of manure or commercial fertilizer prior to side-dress N applications), or plausibly falsifying their records to remain in compliance with IDEM rules. IDEM could limit manure application rates to some multiple of crop P needs so producers cannot justify large increases in application rates to account for N losses due to source, method and timing of manure application. We propose that when using N-based application rates, no application may exceed the crop N fertilizer recommendations after accounting for N losses due to application timing and method or four (4) times the expected crop P removal, whichever results in lower application rate. Limiting applications to some fixed value of maximum N loss due to application method or timing would be another possible approach. For example, one approach would be to limit manure N applications to a fixed amount of potentially available manure N/acre for legume crops. As expressed to IDEM staff previously, we would be happy to draft guidance for IDEM for either or both methods.

C) Soil testing frequency –

327 IAC 19-7-1 Application Requirements
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18-10-2; IC 13-30; IC 25-17.6
(d) CFOs that are subject to IC 13-18-10-1.4 must also provide a summary of the most recent soil testing, which must: (1) be no more than 3 years old;

We suggest changing this to read "...be no more than 4 years old". Purdue University's fertilizer recommendations are built upon a 4 year soil testing interval. In addition, the majority of agricultural land in Indiana is under a corn-soybean rotation. Soil samples are typically taken every 4 years in the fall or spring following the soybean crop. If one considers a "worst case scenario" where manure is applied using an N rate basis (with a 1:1 N:P_2O_5 ratio in the manure) for corn (180 lbs N/acre and 180 bu/acre yield) and soybean (150 lbs N/acre for and 60 bu/acre yield) for 4 consecutive years, soil test P levels will increase only by approximately 26 ppm during this 4 year time interval. Based on the Tri-state Fertilizer recommendations bulletin (Vitosh et al., 1995), 66.6 lbs of P_2O_5/acre are removed in corn grain and 48.8 lbs P_2O_5/acre are removed in soybean seed; so 4 years of crop removal will total 231 lbs P_2O_5/acre which would be the maximum allowable rate for corn assuming that this rate is below the available N rate after accounting for N losses due to time and method of application. The soybean year application would be 150 lbs. P_2O_5/acre assuming a 1:1 manure N:P_2O_5 ratio. If each scenario is repeated twice (2 corn crops and 2 soybean crops), 758 lbs P_2O_5/acre will be applied during this 4 year time period. The net P_2O_5/acre applied will be 758 minus 231 equaling 527 lbs P_2O_5/acre. Since it takes 20 lbs P_2O_5/acre in excess of crop removal to increase soil test P 1 ppm, soil test P

will be expected to increase by 26 ppm. It will not be possible to increase soil test P by more than one soil test P category (0-50, 51-100, 101-200 ppm) during a 4 year period. These rates would only be allowed if the initial soil test P is 50 ppm or less. It is far more likely that producers will apply manure to fields every other year to only utilize the N value of manure for non-legume crops. This more typical manure application strategy, again using the 4 x crop P removal worst case scenario during the corn years, will increase soil test P less than 12 ppm during this same 4 year time period. As soil test P increases to 51 to 100 ppm, cumulative manure application rates during this same 4 year time period would be limited to 346 lbs P_2O_5/acre and the net increase in soil test P would only be 6 ppm. Once soil test P levels reach 101 ppm, no increase in soil test P would be expected as long-term P rates would be limited to crop P removal. A 3 year soil sampling requirement will force producers using a typical corn-soybean rotation to sample in the fall or spring on corn stubble in alternate sampling periods and the fields will be rougher during this time period. This will increase the frustration associated with soil sampling and provide no additional environmental protection. Therefore, the three year soil sampling frequency requirement should be increased to every 4 years.

327 IAC 19-9-1 Requirements
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18-10; IC 13-30
(14) Soil and manure tests must be obtained that provide sufficient information about soil fertility to allow for nutrient recommendations for existing or planned crops and to minimize nutrient leaching.

We suggest clarifying this statement or deleting "and to minimize nutrient leaching" because fertilizer recommendations were not specifically designed to minimize nutrient leaching.

D) Phosphorus availability and testing -

327 IAC 19-7-1 Application Requirements
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18-10-2; IC 13-30; IC 25-17.6
(d) CFOs that are subject to IC 13-18-10-1.4 must also provide a summary of the most recent soil testing, which must:... (2) include phosphorus levels;

Currently, the use of terms such as "soil test P" or "phosphorus levels" need further definition to distinguish which soil test method was implemented (e.g. total P, Mehlich 3, Bray P, or even an Olsen P) which have very different characteristics and implications. Presumably, the rule was meant to provide reference to a Mehlich 3 or Bray P soil test level taken from the 0 to 8 inch depth. This must be clearly stated.

Purdue University guidance should be specified for how to collect soil samples within a field and how the results should be interpreted. We would be happy to develop a publication specifically for this rule.

Sec. 3. (a) The owner/operator of a confined feeding operation shall have the results of a soil test prior to any land application events, as well as a manure test. The tests shall be conducted in accordance with the manure management plan that is submitted to the commissioner to meet the requirement in 327 IAC 19-7-1(c)(7).
(c) Available phosphorus (P) applications from all sources shall be based on the following soil test P values:
(1) Less than fifty (50) parts per million (ppm) soil test P: nutrient application rates allowed up to the N needs of the existing or following crop to be grown.
(2) Fifty to one hundred (50-100) ppm soil test P: P application shall not exceed one and a half (1.5) times the total crop P removal for the existing or proposed crop to be grown.

We suggest editing this to read, "... soil test P values that are less than 51 ppm (or less than or equal to 50 ppm) and 51 to 100 ppm". In bullet (2) "crop" should be "crops" or "crop rotation". The intent of the rule is to limit long term soil test P increases. Producers should be allowed to apply manure at an available N rate as explained in the comment in (b) above as would be applied to (c) (1) above. The long-term P application limits would be managed by the frequency of application as allowed by the other 36 US states we have worked with. For example, if manure is applied at an N rate equal to 3 times the crop P removal rate, then manure would only be applied every other year.

(3) Greater than one hundred (100) ppm soil test P: eliminate P applications, if possible, otherwise P application shall not exceed the existing or proposed crop P removal rate.

Use of the phrase "eliminate P applications" must be removed as it has no place in the rule. Also, the reference to "crop" should be "crops" or "crop rotation" as in (2) above. In this case, however, a manure application made at an N rate equal to 3x the crop P removal rate would result in manure applications being made only every three years. It is not economically feasible, nor easily achievable for manure to be applied on a single year's P removal rate basis, especially with injected liquid manures. Manure injection will increase soil erosion and doing this on 3x the acreage every year increases P loss potential from the operation rather than decreasing P loss potential. IDEM's charge is to protect water quality and allowing P to be managed by frequency of application is more effective than rate of application.

(d) Acreage that has a soil test P level at or exceeding two hundred (200) ppm may comply with the following phase-in schedule, which begins with the effective date of this article: (1) Years one through three (1-3) application rates may continue to be the nitrogen limiting rate in subsection (b) of this

section. (2) After year three (3) the application rate must be phosphorus limiting in accordance with this subsection (c) of this section.

Remove ("at or") in first sentence of (d). This phase-in schedule is not logical for implementing the rule. We are uncertain how producers could be allowed to apply manure on an N rate basis for 3 years on fields with soil test P greater than 200 ppm, but on fields with soil test P greater than 100 ppm and less than 200 ppm, producers must manage the field based on crop P removal. After year three, the current draft of the rule suggests that manure can be managed based on crop P removal regardless of soil test P level. So if a producer has a soil test P level of 1000 ppm, how could they still manage the field based on crop P removal? We suggest that for fields with soil test P greater than 200 ppm but less than 300 to 400 ppm, manure could be managed based on crop P removal for the first three years (basically one application made at an N rate). Following this phase-in period, manure should be limited to ½ crop P removal (manure application on an N rate basis every 6 years). Then in year 10, no manure would be applied to fields with soil test P greater than 200 ppm. This strategy would be far more protective of water quality and allow operations to secure additional land areas or treatment methods for their manure if needed.

E) Soil fertility –

327 IAC 19-7-5 Manure management plan
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30
Sec. 5. (a) A manure management plan must be developed and submitted to the commissioner that contains the following: ....(b) If applicable, the manure management plan must also contain a description of any: ....(c) A soil test must be obtained that provides sufficient information about soil fertility to allow for nutrient recommendations for existing or planned crops and to minimize nutrient leaching. The frequency of this testing must: (1) be specified in the manure management plan; and (2) be conducted a minimum of once every three (3) years unless a different frequency is approved by the department in writing and is included in the manure management plan.

We suggest replacing this language to specify that a soil test must be obtained that provides sufficient information about soil fertility to allow for nutrient recommendations including nitrogen, phosphorus, potassium and lime recommendations for existing or planned crops. The frequency of this testing must:
(1) be specified in the manure management plan; and
(2) be conducted a minimum of once every four (4) years unless a different frequency is approved by the department in writing and is included in the manure management plan."

327 IAC 19-14-4 Manure application activities
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4

Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30
(f) Liquid or solid manure must not be applied to highly erodible land unless:

IDEM should use the USDA-NRCS definition of highly erodible land. IDEM's current definition lacks clarity and is open to interpretation.

F) Available Acreage –

327 IAC 19-7-2 Plot maps
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30
Sec. 2. (a) The applicant shall submit plot maps of the location proposed for approval consisting of the following: (4) Available acreage for manure application after calculation of setbacks using the surface application method.

Setbacks used in the plan should be based on the application method selected by the producer/planner. While we understand the logic behind using setbacks based on surface applications of manure (if the operation has enough land base for surface applications then there will be more than an adequate land base for any other application method), this requirement will pose an undue burden for producers that do not surface apply manure (i.e. inject manure). Even a 40 acre parcel of land with a 100 foot setback will lose approximately 25% of the total acreage compared to approximately 12% with a 50 foot setback if all adjacent property is owned by someone other than the producer. This approach is really analogous to basing soil erosion estimates on the tillage used by the operation rather than forcing them to use moldboard plowing as their tillage in a plan to artificially inflate soil erosion estimates. Producers must have the option of using the appropriate setbacks for their operation based on planned application method.

Our recommendation for additional consistency would be to adopt the Indiana NRCS setback standards for land application of manure to ensure consistency for producers working with both agencies.

327 IAC 19-14-6 Manure application setbacks
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30
Sec 6. (a) Except as otherwise provided under this section, application of manure and process wastewater must be in accordance with the setbacks in...
(4) The setback is ten (10) feet if a gradient barrier is located between the application site and any of the following:
(A) Surface waters of the state....
(3) The setback is the width of the filter strip if a properly designed and maintained filter strip of at least thirty-five (35) feet in width is located between the application site and any of the following:

(A) Surface waters of the state....

"Surface Waters of the State" is not defined (whereas surface water is). We ask for clarification of terminology. For example, in 327 IAC 19-7-3 Farmstead Plan, surface waters of the state are mentioned and this would include private ponds, and thus ambiguity for how private ponds will be interpreted within the rule and whether there is a setback or not (similarly if it is a neighbor's private pond). Most ponds have a berm or levee with a drainage pipe to prevent over topping. The surface water definition includes ponds, but the waters definition excludes private ponds. Since most ponds do have an outlet, there often is contention when runoff after a rainfall from a neighboring farm enters an adjoining landowner's pond with the perception, right or wrong, that this has contributed to water quality impairment in the adjoining landowner's pond (whether manure was present or not). IDEM should clearly define whether application setbacks apply to private ponds (both the CFO operator's pond and neighboring landowner's ponds). Our suggestion would be to make a distinction between ponds with outlets (i.e. ponds with levees) and ponds that do not have outlets. Additionally, we suggest that setbacks should be defined for any pond not under control of the operation.

Appeal of Violation and Manure Management Plan Deviations –

327 IAC 19-14-3 Manure application rates
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18-10; IC 13-30
(7) Calculations showing the total nitrogen and phosphorus to be applied to each field, including sources other than manure, litter, or process wastewater.
(8) Total amount of nitrogen and phosphorus actually applied to each field, including documentation of calculations for the total amount applied.

With comments rendered for the first notice of the CFO rule, there was concern expressed for an animal operation filing an appeal for a violation. The IDEM response did not adequately address this particular comment. Aside from court action there is no provision for a producer to dispute an inspector's finding and expunge their record following a cited violation. Additionally, the rule leaves sufficient vagueness as to how differences between manure application and cropping plans and actual implementation will be interpreted by inspectors. What if there is a wet spring and a planned field for corn is delayed in planting and soybeans are planted instead? While these could be interpreted in the current language of the draft rule as a violation, they do not likely provide for any long-term environmental consequence if the manure management plan is subsequently adjusted to account for differences in successive crop(s) nutrient uptake.

The above statement within the rule must be revised to read "available manure nitrogen and total manure phosphorus". As written, it implies that IDEM wants to include sources other than manure, which goes beyond the mandate of this rule. If manure N losses due to application timing and method

are not allowed in the determination of available manure N, then this is a trap for nearly every operation covered by this rule. Producers will not jeopardize a crop failure due to a N deficiency on non-leguminous crops, so they will be forced to apply commercial fertilizer N to make up the difference between N losses due to application method and timing, and thus yet an additional cost to the producer for another trip across the field to apply N. In 2008, IDEM personnel stated that any producer who applied manure based on potentially available manure N (no losses due to application method or timing) that also applied commercial fertilizer N would be cited for an over-application of N unless they had used the PSNT to document the need for more N. This leaves producers in an untenable position. The most generous assumption that we are willing to allow is that 200,000 acres of corn (equivalent to 3 percent of the IN corn crop) use the PSNT soil test, so most producers could plausibly falsify their records because IDEM's current approach to estimating manure N availability is not based on science in any conceivable way.

Co-permitting language –

> **327 IAC 19-2-27 "Owner/operator" defined**
> **Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4**
> **Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30**
> **Sec. 27. (a) "Owner/operator", for purposes of this rule, means the person:**
> **(1) that owns the waste management systems at the confined feeding operation;**
> **(2) that owns the livestock at the confined feeding operation and that applies for or has received an approval pursuant to this article; or**
> **(3) in direct or responsible charge or control of one (1) or more confined feeding operations or land application activity. (b) The term includes contractors responsible for activities described in 327 IAC 19-1-1(a) at the confined feeding operation.**

Clarification is needed as to whether this also would include a third party applicator and/or contractor and what activities from IAC 19-1-1(a) would constitute a co-permit. We submit that the person or entity responsible for the "activity" and "management" be the legally responsible entity for the purposes of the permit.

Ground water monitoring –

> **327 IAC 19-10-1 Ground water monitoring**
> **Authority: IC 13-13-5-1; IC 13-15-1-2; IC 13-15-2-1**
> **Affected: IC 13-18-10**
> **Sec. 1. (a) All CFOs required to conduct ground water monitoring must comply with the requirements of this section. (b) Owners/operators of a manure storage facility shall develop and follow a written ground water monitoring plan. This plan must: (1) be approved by the department; (2) be kept in the operating record; and (3) include the following: (i) Monitoring parameters, including: (AA) Field pH; (BB)**

Field Specific Conductance; (CC) Ammonia-N; (DD) Chloride; (EE) Fecal Coliform Bacteria; (FF) Nitrate-N; (GG) Phosphate; (HH) Sulfate; and (II) Total Organic Carbon;

Use of the phrase "All CFOs required to conduct ground water monitoring must..." is unclear as to whether "All CFOs" or "CFOs with a particular site risk or spill history" are needed to conduct ground water monitoring. Please provide further clarification to define exactly which CFOs must conduct ground water monitoring. Further, there is no specification as to "where" to test relative to the production and storage areas. Use of "statistical determinations" and "statistically significant increases" are highly dependent on number of tests to determine baseline. Requiring the producer to do this is illogical. Timing of monitoring is also inconsistent versus that for storm-water monitoring. Regarding the monitoring parameters listed, analyses for field pH and conductance will not add any particular water quality implication. Measurement of phosphate and sulfate are not direct indicators of a potential to impact human health.

Storm water runoff and sampling – Storm water monitoring is neither practical nor reasonably enforceable. If managed with an approved plan, monitoring should not be required, unless under specific conditions which should be stipulated by IDEM.

327 IAC 19-11-2 Contents
Authority: IC 13-13-5-1; IC 13-15-1-2; IC 13-15-2-1
Affected: IC 13-18-10
(6) A monitoring plan which shall:
(B) include methods to quantify sediment and nutrient loadings in storm water discharges including:
(i) total suspended solids (TSS);
(ii) ammonia (NH4+); and
(iii) biological oxygen demand (BOD).(7) Sampling of storm water which shall: (A) be conducted annually; (B) be conducted on each representative storm water outfall; and (C) be collected from the discharge resulting from a storm event that is greater than one tenth (0.1) of an inch and at least seventy two (72) hours from the previous storm event that was greater than one tenth (0.1) of an inch;

The rule needs a definition for "storm water outfall" and we suggest removing TSS as it does not have a direct environmental impact (e.g. if there was more sand in the sample, this would increase TSS). We also suggest that IDEM insert wording to allow a discharge if it is able to attain certain quantifiable concentrations (e.g. a specific COD). Additionally, measurement of BOD is expensive (approximately $30 to $40/sample) and relatively inaccurate as it is a microbial bioassay. We suggest if monitoring is to be used, that COD is a better indicator of oxidation capacity of organic matter and a much more accurate measure. Ideally, monitoring should be removed from this rule as the planning approval and

maintenance/operation should be sufficient, because of the huge variation between sampling time, location, weather and conditions prior to sampling, etc.

> **Sec. 2. A storm water pollution prevention plan must include:**
> **(1) Facility name and contact information;**
> **(2) Receiving water(s) of storm water from the production facility;...**
> **(4) A description of potential pollutant sources, including:**
> **(vi) A description of any treatment the storm water receives, including the ultimate disposal of any solid or fluid wastes other than by discharge.**

Storm water from the production facility should be minimized as much as possible through conservation and other techniques. IDEM should allow for treatment systems (e.g. filtration strips) prior to release from the production area. Storm water capture structures and grading will result in substantial cost to the operation and plausibly sets the operation up for failure during significant rainfall events. IDEM is requiring either additional earthen storage facilities for storm water runoff, or placing additional burden for storm water collection and storage into existing manure storage structures. Since the existing storage structures have not been designed for this additional capacity, there is a greater potential for these facilities to fail.

(4) This statement is confusing if discharge is not allowed. IDEM should remove "other than by discharge".

> **327 IAC 19-12-3 Storage capacity and design requirements for all manure storage facilities**
> **Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4**
> **Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30**
> **Sec. 3. (a) All manure storage facilities for the confined feeding operation must be designed, constructed, and maintained with a combined storage capacity of at least one hundred eighty (180) days storage for:**
> **(7) normal run-off;**
> **(8) if applicable, the expected precipitation and run-off from a twenty-five (25) year, twenty-four (24) hour precipitation event that falls on the drainage area around the manure storage facility that contains liquid**
> **(b) All manure storage facilities must be constructed to minimize leaks and seepage and prevent spills that could contaminate ground water or surface water.**
> **(c) All manure storage facilities must be designed to handle the run-off from a twenty-five (25) year, twenty-four (24) hour precipitation event on the entire production area.**

Definition is needed here for "normal run-off". Within (c) above, should this be "precipitation" rather than "run-off"? We refer to our previous comments that release of storm water from the production

facility should be allowed after proper treatment (e.g. filtration strips), thus not placing additional burden and setting the facility up for plausible failure of existing manure storage facilities.

> **327 IAC 19-14-4 Manure application activities**
> **Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4**
> **Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30**
> **(g) Any manure application that causes a water quality violation is a violation of this article and will result in enforcement action.**

This statement substantially ignores the federal agricultural storm water exemption. If a producer has developed and follows (with appropriate records) a nutrient management plan, water quality violations that result should automatically receive the federal agricultural storm water exemption. Thus we contend that this statement should be significantly revised or removed.

Required land application acreage –

> **327 IAC 19-14-7 Marketing and distribution of manure**
> **Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4**
> **Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30**
> **(e) If a manure distribution program is used, IDEM may allow for a waiver of up to seventy five (75) percent of a facility's total land application acreage requirements if the documentation as described in subsections (b) and (c) of this section from the previous two (2) years is submitted showing the operation has sold or distributed at least seventy five (75) percent of the manure produced at the facility.**

We feel that the restrictive nature of the waiver of the land application acreage unduly penalizes operations with a history of marketing more than 75% of their manure (in some cases up to 100%). In other words, present wording would require acreage despite some cases wherein manure would never be applied by the CFO, which likely may cause an undue additional financial burden for an operation. Any operation that exports some manure should only be required to have the land base needed to manage the manure that is not exported. Thus, the applicability of this rule is also in question for new operations (i.e. require 100% of the land unless they can show 2 year history of marketing manure). How can a new CFO show a 2 year history? The timing of this rule as well as guidance and educational programs for poultry and livestock producers must be in concert with implementation of the "nutrient application certification" program from the Office of the IN State Chemist.

> **Sec. 2. (a) All CFOs must maintain a minimum number of acres for manure application based on manure application rates from 327 IAC 19-14-3. This must be documented in the operating record at all times and must be included in all applications, except applications for new CFOs.**

We are uncertain why there is an exception of maintenance of a minimum number of manure application acres for new CFO's if the operation is capable of documenting alternative technology or marketing agreements for the manure.

Design criteria for manure storage

> **327 IAC 19-12-4 Design and construction requirements for all waste management systems**
> **Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4**
> **Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30**

Most of the design criteria for liners are in line with what the NRCS recommends in the animal waste management field handbook (AWMFH). In Appendix 10D of the AWMFH (http://www.wsi.nrcs.usda.gov/products/w2q/awm/docs/handbk/awmfh-chap10-app10d.pdf), it recommends looking at a thicker liner if the depth exceeds 9 or 10 ft. Some states mandate a thicker liner. Texas just recently added a seepage rate to the requirements. Within the agricultural engineering and NRCS community, there is considerable debate over whether a clay liner can be installed with a $1x10^{-8}$ cm/s permeability and truly have that permeability throughout the entire construction. For example, in Texas those discussions are deferred to the Texas Commission on Environmental Quality (TCEQ) and require a licensed Texas Professional Engineer to certify the liners.

The seepage or specific discharge calculations of $^{1}/_{56}$ cubic inch per square inch of area per day will depend upon the depth of the typical waste impoundment considered in Indiana, the thickness of the clay liner, plus the hydraulic conductivity. Appendix 10-D suggests a minimum clay liner depth of 1 ft.

The stipulation of specific technologies (i.e. geo-textile liners) severely limit the capacity for future implementation of technologies which may have similar capacity are limited. For this reason, we suggest not targeting a specific technology, but rather the performance standard.

The primary problem with construction and monitoring standards is that, often, it would be decades before a possible liner failure would cause contamination that may or may not show up in monitoring wells. Therefore, measuring the seepage itself would be better. Second, there is absolutely no guidance on performance standards as a result of construction, so the CFO is allowed (or forced) to develop their own method. Third, the emphasis in the rule is on "statistical significance", which our estimation is usually interpreted to mean that unless there is 95% confidence of contamination, there is assumed to be no problem. Environmental data has inherent uncertainty and that assumption could risk failure to protect the public. The quote below from a Journal of Environmental Quality article suggests that testing may be a better indicator of performance.

"Performance testing of lagoons after construction should be an integral component of a site-specific design strategy. Without field testing, AFO owners and their neighbors will always wonder if a lagoon is really performing within the standards prescribed by the site-specific framework. Several researchers

have shown that whole lagoon seepage rates can be measured quickly to within ±0.2 mm d-l using water-balance methods (Glanville et al., 1999; Ham, 1999; Ham and DeSutter, 1999). Seepage should be measured no sooner than 6 mo after waste has been added to the lagoon so that a mat of organic bottom sludge has time to develop. Data suggest that the permeability of lagoon liners does not change significantly after 3 to 6 mo of operation (Hills, 1976). Performance- based testing will provide additional incentives for engineers and contractors to maintain quality control throughout the design and construction phases. ....Many states are now considering the use of monitoring wells as a way to verify that no pollution is occurring from lagoons. However, it can take years for contaminants to reach a monitoring well, and a subsurface plume from the lagoon may not transect the well location." JEQ 2000. 29:1721-1732

Thus, our contention is that performance criteria should only be required when there is a need based on site risk. In addition, standard, economical, and accurate testing methodology for any performance criteria need to be available, but should not exclude new technological measures for failure and/or contamination.

(4) the concrete must be constructed according to the NRCS standard: Construction Specification, Concrete Construction, October 2005 Edition.

In previous conversations and public meetings, IDEM has indicated that the agency would clarify any standard within the rule itself, rather than provide direct reference to a separate agency's document as is done here for the construction specifications.

327 IAC 19-7-5 Manure management plan
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30
(6) Procedures for managing the migration and removal of solids from the manure storage facility, including procedures to ensure required structural integrity and manure storage capacity.

Is this statement intended to address lagoon sludge management? If so, we suggest requiring a statement regarding how lagoon sludge will be managed based on the designed sludge volume for the lagoon. If this is also intended for under-floor liquid pits, then a statement would be needed to clarify how solids build up will be controlled. This statement needs significant revision to convey a clear message.

While not defined within the rule itself, we also suggest for improvement in allowance for design of lagoons to allow an emergency overflow as to not cut a "trough" into the side of the berm of the lagoon.

Application to snow and frozen ground –

> **327 IAC 19-14-4 Manure application activities**
> **Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4**
> **Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30**
> **(e) The following manure application activities are prohibited:**
> **(1) the application of manure to frozen or snow covered ground;**
> **(2) the application of manure to saturated ground**

We suggest rephrasing to read "No surface applications to land with > 2% slope or to bare/tilled ground" to account for provisions where injected manure applications below the frost line could be accomplished. Additional provisions are suggested to account for emergency applications in the case of outside storage that have received precipitation in excess of a 25 year-24 hour storm, or for water leaks or other unforeseen events if the operator gets prior IDEM approval.

Tile-line monitoring –

> **(e) Land application sites must be inspected to identify any field tile outlets, grassed waterways, and surface water conveyance channels under or immediately bordering the land application site. Monitoring of identified field tile outlets, waterways, and surface water conveyance channels based on: (1) color; (2) flow; (3) volume and volume change; and (4) odor and change in odor; must occur during and immediately following land application of the manure or process wastewater. If there is evidence of manure or process wastewater discharging from the field tile outlet, the land application must cease immediately and the flow stopped or captured. Any flow that is captured shall be either land applied or returned to an approved manure storage facility. (f) The monitoring activities conducted in accordance with subsection (e) of this section must be documented and placed in the operating record.**

We question why monitoring of NH_4^+ from tile-lines is being referred to in the rule without description of when it should be done relative to manure application. In many cases, there is no direct tile outlet on the field to which the manure is being applied. The outlet may come from multiple fields which likely would be owned and operated by adjacent landowners and which could include their field (and plausibly septic) outflow. This, of course, is beyond the manure applicator's control. For these reasons, we do not agree that all tile outflow need be monitored, but rather this ought to be placed into the guidance document explaining that when it is feasible to monitor tile-line exit on property then the manure applicator should do so. Thus our contention is that monitoring should not be required for land application areas if producers are following a nutrient management plan and thus should be able to receive the federal storm water discharge exemption. Monitoring storm water for sediment and nutrient loading is not practical and does not provide any useful additional information.

327 IAC 19-13-1 Maintenance requirements
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30
(h) Field tile outlets must be field sampled annually for Ammonia (NH_3).

Because ammonia is a gas (NH_3), samples would generally come out 0. Capping or visibly monitoring known tile outlets could be suggested as best management practices in the guidance but this does not belong in the rule.

Mortality management –

327 IAC 19-7-6 Mortality Management Plan
Authority: IC 13-13-5-1; IC 13-15-1-2; IC 13-15-2-1
Affected: IC 13-18-10

As worded, the mortality management plan creates a burden particularly for cattle producers. Cattle that are 30 months of age or older are only allowed to be rendered after removal of specified risk material (including the brain and spinal column) due to bovine spongioencephalopathy (BSE) restrictions. The implementation of these restrictions have created additional challenges for producers and, in some locations, has either resulted in the loss of rendering options or rendering options that are extremely restrictive for producers. The current requirements in the outlined mortality management plan would make carcass disposal for many livestock producers very challenging or impossible. Producers whose land base is comprised of one of the listed soil types that would preclude burial and who do not have a rendering option available to them, will have no other options besides composting. Proper facilities, equipment, and runoff containment needed to meet requirements for composting large animal carcasses would be extensive and would put unnecessary financial burdens on producers with limited benefits to protecting water quality.

Eliminating burial in certain soil types is very restrictive and does not allow any flexibility for implementation of technology and management strategies. Producers with the listed soil types should have to ability to bury livestock if they can show that proper steps have been taken to preserve water quality. Also, restrictions referring to scavenging by other animals have no relevance to water quality and should be removed from the rule.

Applicability of permit modifications –

We suggest modifications to this section to not require producers apply for a new permit, such that they could increase animal numbers up to a specified percentage above which is currently permitted (we would suggest 10%) if the manure storage capacity is sufficient.

Transport, handling and emergency spills

> **327 IAC 19-13-3 Transport and handling**
> **Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4**
> **Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30**
> **Sec. 3. Pumping, dumping, or allowing the leakage or drainage of manure from a vehicle, tank, or wagon used to move manure onto unauthorized premises, public thoroughfares, or into waters of the state is prohibited.**

We are uncertain as to what is meant by an authorized premise and can one pump, dump, leak or drain manure onto an authorized premise?

> **327 IAC 19-13-4 Emergency spill response plan**
> **Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4**
> **Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30**
> **Sec. 4. (a) The owner/operator of a confined feeding operation shall develop an emergency spill response plan to be kept in the operating record. The plan shall contain:....(C) Returning spilled manure or waste liquids to an approved waste management system;**

We suggest that land application of the spill material collected should be an option here at agronomic rates similar to the statement at the end of 19-14-6 (e).

> **327 IAC 19-14-5 Spray irrigation**
> **Authority: IC 13-13-5-1; IC 13-15-1-2; IC 13-15-2-1**
> **Affected: IC 13-18-10**
> **Sec. 5. (a) Spray irrigation of liquid manure and process wastewater must be conducted to prevent equipment leaks and excessive application. Application is deemed excessive when the application rate exceeds the infiltration rate of the soil where the application is occurring, expressed in inches per hour.**

This statement is ambiguous. The instantaneous application rate under typical irrigation systems will exceed the infiltration rate of the soil. Also, soil specific infiltration rates are not available. Saturated conductivity classes are available but nearly all irrigation equipment would exceed these values at the time when manure is actually being applied to a specific area as the irrigation equipment passes over the land. Limiting one-time application rates to some fraction of an acre-inch (13,500 gallons/acre would be 0.5 acre-inches and 7000 gallons/acre would be 0.25 acre-inches) would be a much more effective and practical approach to addressing this water quality concern. Perhaps IDEM could use language similar to that found in 19-14-6 (d), or change this to state the implied intent of not allowing for excessive ponding or runoff.

> **(d) Spray irrigation in a flood plain is prohibited unless the following conditions are met: (1) The setback from surface water is increased to two hundred (200)**

feet. (2) Spraying is only done during months that the current county soil survey book indicates have a low potential for flooding. (3) There is no expectation of flooding, based on: (A) available weather forecast information; and (B) rainfall or flood conditions upstream within the drainage basin.

County soil survey books are no longer the official source of NRCS soils information. Those data reside in the NRCS soil data mart. Additionally, the term "drainage basin" needs to be defined, as one could interpret this as the entire Mississippi River drainage basin (as an example). This must be explained in terms that are not ambiguous and can be readily interpreted by producers and their advisors.

Operation expansion

327 IAC 19-1-2 Applicability
Authority: IC 13-14-8-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-18; IC 13-22
Sec. 2. (a) This article applies to all CFOs as defined in IC 13-11-2-40.
(b) Under this article a person may not start:
(1) construction of a confined feeding operation; or
(2) expansion of a confined feeding operation that increases animal capacity or manure containment capacity, or both;
without obtaining the prior approval of the department.
(c) Unless otherwise stated, all requirements of this article must be met upon its effective date.
--Also—
327 IAC 19-6-1 Existing confined feeding operations
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18-10-2.3; IC 13-30
(d) Any increase in animal capacity, animal number, or manure containment capacity requires a new application pursuant to IC 13-18-10-1 and the requirements therein.

We would suggest that IDEM change this to read "Any increase in animal capacity, animal number, or manure containment capacity if above 10% of the number of approved animals", and if the manure storage capacity and manure management plan were sufficient to handle this amount of additional animals for the specified length of time, the re-permitting process likely is not needed.

Definition clarification -

327 IAC 19-2-6 "Constructed wetlands" defined
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 4-21.5; IC 13-11-2-40; IC 13-14; IC 13-15; IC 13-18-10; IC 13-30
Sec. 6. "Constructed wetlands" means an approved waste management system designed to maximize the removal of pollutants from process wastewater or other

runoff through wetland vegetation uptake, retention and settling. (Water Pollution Control Board; 327 IAC 19-2-6)

We suggest editing to add "treated" lagoon effluent to this definition.

327 IAC 19-2-7 "Construction" defined
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2-40.8; IC 13-14; IC 13-15; IC 13-18-10; IC 13-30
Sec. 7. "Construction", as defined in IC 13-11-2-40.8, for purposes of IC 13-18-10, means the fabrication, erection, or installation of a facility or manure control equipment at the location where the facility or manure control equipment is intended to be used.

For clarification for producers, this rule should also define what a "facility" is.

327 IAC 19-2-25 "Manure transfer system" defined
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30
Sec. 25. "Manure transfer system" means any pipes, lift stations, pumps, or other stationary devices used for the transfer of manure.
(Water Pollution Control Board; 327 IAC 19-2-25)

We suggest addition of "channels or anything that will convey manure".

327 IAC 19-2-29 "Process wastewater" defined
Authority: IC 13-14-8; IC 13-14-9; IC 13-15-1-2; IC 13-15-2-1; IC 13-18-3
Affected: IC 13-11-2; IC 13-18-4
Sec. 29. "Process wastewater" means any water that, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product.

We suggest that "manufacturing and processing" be further defined and specific examples be given within the guidance document to make this clearer for a producer.

327 IAC 19-2-43 "Waste liquid" defined
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4

Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30
Sec. 43. "Waste liquid" means liquid to be handled as manure that is generated at the confined feeding operation, including: (1) excess drinking water; (2) clean-up water; (3) contaminated livestock truck or trailer washwater; (4) milking parlor wastewater; (5) milk house washwater;
(6) egg washwater; or (7) silage leachate. (Water Pollution Control Board; 327 IAC 19-2-43)

The term "clean-up water" needs further definition as there can be questions whether this is applicable to water used for sanitation and whether water from misters or ventilation cooling or milk cooling would be included.

Rule 5. Alternate Design or Compliance Approach; Innovative Technology
327 IAC 19-5-1 Alternate design or compliance approach; innovative technology
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30

For Alternate technologies, clarification is needed (and examples and targets given within the guidance document) if the target for the technology was to create "clean" effluent/water for discharge and how this would fit into the existing rule. What is the performance standard for discharge?

327 IAC 19-11-2 Contents
Authority: IC 13-13-5-1; IC 13-15-1-2; IC 13-15-2-1
Affected: IC 13-18-10
Sec. 2. A storm water pollution prevention plan must include:
(i) immediate access roads and rail lines used or traveled by carriers of raw materials, waste material, or by-products used or created by the facility;
(ii) refuse sites;
(iii) Paved, dirt or gravel parking areas for storage of vehicles to be maintained.

We question why the access roads and rail lines used for raw materials is needed for storm-water protection. Most raw materials are delivered covered or in containers, so how is inclusion of access roads and rail lines protective of water quality? What is the extent of "immediate" and how it may be interpreted? The term "immediate" must be defined in this context. Definition of the term "refuse" sites must be clarified and examples given within the guidance document. Rationale is also needed to justify why the vehicle storage areas are relevant to this rule.

327 IAC 19-13-3 Transport and handling
Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4
Affected: IC 13-11-2; IC 13-14; IC 13-15; IC 13-18; IC 13-30
Sec. 3. Pumping, dumping, or allowing the leakage or drainage of manure from a vehicle, tank, or wagon used to move manure onto unauthorized premises, public thoroughfares, or into waters of the state is prohibited. (Water Pollution Control Board; 327 IAC 19-13-3)

Clarification of "public thoroughfares" may be warranted. Again, what are "authorized premises"?

Renewal of permits after 5 years -

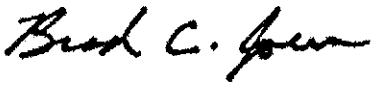
> **327 IAC 19-8-2 Approval renewals**
> **Authority: IC 13-14-8-7; IC 13-15-2-1; IC 13-18-10-4**
> **Affected: IC 4-21.5; IC 13-11-2; IC 13-14; IC 13-15; IC 13-18-10-2.3; IC 13-30-3**
> **(4) A farmstead plan, as described in 327 IAC 19-7-3.**

Notably, if the farmstead plan has not changed from the original approved permit, we contend that a new one is not needed for the renewal.

In summary, we trust our comments will be considered for their technical merits, in their capacity to substantially improve the feasibility, lessen the economic burden, and improve the capacity of the intended policy to improve the water quality within Indiana. As relayed from the outset of this letter, substantial guidance and outreach will be needed from the agency for timely and effective implementation of this new policy for livestock producers. Purdue University Cooperative Extension staff and faculty are willing to be a part of this effort, and we are available to begin dialog with the agency to plan for effective outreach to Indiana stakeholders. Thank you for the opportunity to comment on this draft of this revised rule.

Sincerely,

Todd J. Applegate, PhD
Professor of Animal Sciences



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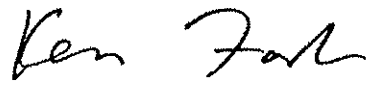

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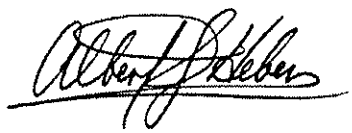

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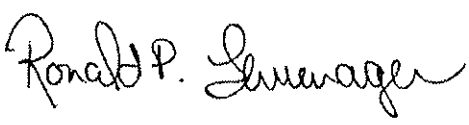

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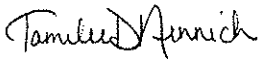

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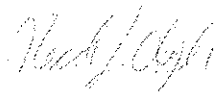

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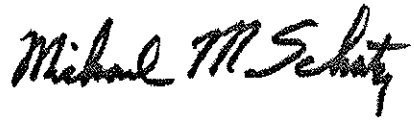

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